MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: CLEVELAND ABBE, jr.

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The MONTHLY WEATHER REVIEW summarizes the current manuscript data received from about 3,500 land stations in the United States and about 1,250 ocean vessels; it also gives the general results of the study of daily weather maps based on telegrams or cablegrams from about 200 North American and 40 European, Asiatic, and oceanic stations.

The hearty interest shown by all observers and correspondents is gratefully recognized.

Acknowledgment is also made of the specific cooperation of the following chiefs of independent, local, or governmental services: R. F. Stupart, Esq., Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Señor Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; Dr. W. N. Shaw, Director of the Meteorological Office, London; Maxwell Hall, Esq., Government Meteorologist, Kingston, Jamaica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba; Señor Luis G. y Carbonell, Director, Meteorological Service of Cuba, Havana, Cuba; Rev. José Algué, S. J., Director of the Phillipine Weather Bureau, Manila; Maj. Gen. M. A. Rykachef, Director of the Physical Central Observatory, St. Petersburg, Russia; Carl Ryder, Director, Danish Meteorological Institute, Copenhagen, Denmark.

As far as practicable the time of the seventy-fifth meridian is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea-level and latitude 45°.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

An abnormal distribution of atmospheric pressure is invariably associated with marked departures from seasonal weather. During the past winter pressure was abnormally low over the northern Pacific and thence over and near the boundary between the United States and British America and was unusually high over the southern Pacific and southwestern portions of the United States. This arrangement of pressure caused a prevalence of mild southerly winds over the United States and drew over the extreme British Northwest Territory exceptionally cold winds from the Far North. At times there were reversals of this pressure distribution and cold air masses swept southward over the United States. A notable instance of this kind occurred during the first decade of January, when from North Dakota to Washington and northern Oregon the cold exceeded any previous record for the same period. The fact that the reversals of prevailing pressure conditions, with subsequent cold-wave visitations, were in each instance foreseen, furnishes additional evidence of the value of pressure charts that permit a daily survey of the oscillations and movements of the great centers of action of the Northern Hemisphere. By the aid of these charts the cold-wave warnings of the past winter were exceptionally accurate, and they were for the first time successfully made for periods of several days in advance.

The first important storm of March, 1909, moved from the Northwest rapidly southeastward to the middle Atlantic coast during the 2d and 3d, where it deepened rapidly and turned sharply northward near and off the coast during the night of the 3d, attended over the Atlantic States north of Virginia by rain or snow and high north to northwest winds. Until the passage of its center over the Atlantic coast line this storm possessed moderate strength only. The abnormal checking of its eastward progress and its subsequent increase in intensity and sharp recurve to the northward were due to conditions that existed over the ocean beyond the region of observation. The usual features that attend the continental class of storms to which this storm belonged were forecast, and warnings of the gales that swept the Atlantic coast the night of the 3d and during the 4th were issued the morning of the 3d. The rain, snow, and high winds of the night of the 3d and morning of the 4th prostrated electric wires and seriously interfered with communication and transportation in the Middle Atlantic States.

During the week ending Saturday, March 13, an extensive area of precipitation covered the country from British America to the Mexican border and the Gulf of Mexico. In the North, West, and Southwest the precipitation was in the form of snow, and in the middle and east Gulf States and Georgia heavy rains caused flood stages in streams. Following the precipitation, the weather was exceptionally cold in the middle and southern Rocky Mountain districts, and on the morning of the 13th minimum readings of 2° and 24° were reported at Roswell, N. Mex., and El Paso, Tex., respectively. During the succeeding two days frost-producing temperatures extended eastward over the Gulf and South Atlantic States.

The following special forecast was issued Sunday, March 14:

> During the present week a disturbance will advance from the Pacific to the Atlantic coasts from about Tuesday to Friday, preceded and attended by rising temperature and by general rains in middle and southern districts and by snow in the more northern States, and followed by a period of cooler, fair weather that will set in over the Northwestern States Tuesday night and reach the Atlantic seaboard about the close of the week.

The disturbance referred to appeared Tuesday, the 16th, over the Pacific States, and its center reached the Atlantic coast Friday night, the 19th. Its passage was attended by snow from the Missouri Valley over the Southern and Southeastern States. It was followed by lower temperature that set in over the Northwest Tuesday night and reached the Atlantic and east Gulf States Saturday.

On the 20th heavy rain set in over California. During the succeeding three days the rain area extended over the Middle, Western, and Southwestern States, with heavy snow in the middle Rocky Mountain districts. On the 24th the rains extended over the central valleys, Lake region, and Atlantic

States. During the 25th and 26th pressure was very low over the Atlantic States, with minimum readings about 28.90 inches from northern Virginia to southern New England on the 25th. Following this depression snow fell as far south as eastern Tennessee, and frost occurred the morning of the 26th in the middle and east Gulf and South Atlantic States. During the closing days of March kite flights at Mount Weather, Va., showed unusually low temperatures at an altitude of about 1 mile. On the 30th the temperature gradient to that height was 26° and on the 31st it was 22°, the average gradient being about 15°. The presistent cloudiness of this period in the Middle Atlantic States may be attributed to the unusually low temperature of the upper air that overlaid that region.

BOSTON FORECAST DISTRICT.*

[New England.]

The weather, generally speaking, was that of the average March. Snowfall was heavy in northern and moderate to light over other portions of the district. At the close of the month snow was 3 or 4 feet deep in the woods and mountains of the northern sections. The only severe storm was that of the 25–26th during which gales of great force swept the entire coast. During the storm a number of schooners and smaller craft were driven ashore, and some damage was caused to shore property. Warnings were issued well in advance of the gale and were of great benefit. Relative to the warnings the Boston Herald remarked as follows: "The storm warnings signaled from Cape Hatteras to Eastport saved many skippers from the gales which piled up the roughest sea that has run on the Atlantic coast in many years."

There were no storms during the month without warnings.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.*

[Louisiana, Texas, Oklahoma, and Arkansas.]

There was an excess in temperature and a deficiency in precipitation throughout the greater part of the district. Warnings were issued for all severe weather conditions that occurred during the month.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.*

[Kentucky and Tennessee.]

Temperature and precipitation averaged about normal. The coldest weather occurred about the middle of the month, and the principal rain periods were the 5–6th and 8–9th when there was considerable flooding in the streams and over the lowlands.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.*

[Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Montana.]

There were no unusual weather features in the district during the month. No cold-wave warnings were issued and no severe gales occurred on Lake Michigan.—*H. J. Cox, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.*

[Wyoming, Colorado, Utah, New Mexico, and Arizona.]

The lowest temperatures of the month were recorded from the 8th to 15th. In southeastern Wyoming and in the north-central counties of Colorada the snowfall of the month was unusually heavy.—*P. McDonough, Local Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.†

[California and Nevada.]

The month was in most respects a typical March month. The number of barometric disturbances was below the average. In the central portion of California the average number of rainy days was thirteen, or three days more than normal. No frost warnings were issued.—*Alexander G. McAdie, Professor of Meteorology.*

PORTLAND, OREG., FORECAST DISTRICT.†

[Oregon, Washington, and Idaho.]

Although stormy weather prevailed during the opening and closing days the month on the whole was unusually quiet. Precipitation was below and temperature slightly above normal. There were many frosty mornings, but no cold spells worthy of note. Snow in the mountains at the end of the month was deeper than usual, while that on the southern slopes thawed so slowly that none of the rivers reached a flood stage.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

At the end of February, 1909, the Ohio River was above flood stage from Maysville, Ky., to the mouth of the Tennesee River, with the crest of the flood nearing Evansville, Ind. The flood stage of 45 feet was reached at Cairo, Ill., on March 2, and from that day until March 22, inclusive, the river remained above the flood stage below the mouth of the Tennessee River. The crest stage of 47.3 feet was reached at Cairo on the 17th. In the lower Mississippi River flood crests and dates thereof were as follows:

Station.	Crest stage.	Flood stage.	Date.
	Feet.	*Feet.*	
New Madrid, Mo	38.6	34	March 18
Memphis, Tenn	38.6	33	March 22
Helena, Ark	47.7	42	March 25
Arkansas City, Ark	50.1	42	March 28–30
Greenville, Miss	44.8	42	March 29, 30
Vicksburg, Miss	48.1	45	April 2, 3
New Orleans, La	17.9	18	April 3

Owing to the excellent condition of the levees, and to the warning given to remove property, etc., from unprotected land, the Mississippi flood passed off without unusual incident, and almost entirely without losses or damage. The flood was a rapid one and in the Memphis district there was very little delay in farm work. The completion of the levee in front of Reelfoot Basin, Tenn., has disturbed the gage relations previously existing at all places between Cairo and Memphis, and the following interesting statement on the subject was prepared by Mr. S. C. Emery, Official in charge, Local Office of the Weather Bureau at Memphis, Tenn.

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As this was the first high water that has occurred since the completion of the levee in front of the Reelfoot Basin, it is of special interest to note its effect on gages below Cairo, Ill. Heretofore, whenever the river at Cairo reached a stage of 38 feet, or 29 feet at New Madrid, Mo., the water began to flow out to the Reelfoot Basin, in which, during flood periods, a large amount of water was stored. In this way a considerable portion of the water passing Cairo did not reach New Madrid, but passed around that point and a portion reentered the Mississippi several miles below New Madrid near Fulton, Tenn. Since 1907 a levee has been constructed from near Hickman, Ky., to the high bluffs above Tiptonville, Tenn., its purpose being to keep the Mississippi water in flood time from flowing over the low banks in that section into the Reelfoot district. By forcing the water to pass New Madrid the flood plane at that place has been increased about 2½ feet, that is, instead of a difference between Cairo and New Madrid of 11 feet as shown during former periods of high water, it is now seen that this difference has been reduced to less than 9 feet and in extreme high water the difference is expected to be still less. The effect of closing the Reelfoot Basin appears also to have raised the flood plane at Memphis, Tenn. In former years the difference in the gages at Cairo and Memphis has been 10 feet or more. In 1907 when the extreme stage was 40.3 feet the difference in crest stages at Cairo and Memphis was 10.6 feet, while in the present rise the difference is only 8.7 feet and it seems probable that when higher levels are reached this difference will be close to 8 feet. At Helena, Ark., there seems to be little or no change in the gage relation with either Cairo or Memphis, the difference still being approximately 10 feet.

Along the lower Ohio River conditions were not so favorable. Bottom lands were overflowed for a considerable period of time and much inconvenience resulted, especially to those who were driven from their homes, but the actual damage was small.

There were moderate floods in the White River of Arkansas at various times from March 8 to 22, inclusive, for which

* Morning forecasts made at district center, night forecasts made at Washington, D. C.

† Morning and night forecasts made at district center.